

PCT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
 US Department of Commerce
 United States Patent and Trademark
 Office, PCT
 2011 South Clark Place Room
 CP2/5C24
 Arlington, VA 22202
 ETATS-UNIS D'AMERIQUE
 in its capacity as elected Office

Date of mailing (day/month/year) 04 July 2001 (04.07.01)	
International application No. PCT/US00/23267	Applicant's or agent's file reference 194038PCT
International filing date (day/month/year) 24 August 2000 (24.08.00)	Priority date (day/month/year) 24 August 1999 (24.08.99)
Applicant LONG, Mark et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
 21 February 2001 (21.02.01)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer H. Zhou Telephone No.: (41-22) 338.83.38
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(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
1 March 2001 (01.03.2001)

PCT

(10) International Publication Number
WO 01/14602 A3

(51) International Patent Classification⁷: **B22D 15/00**,
27/04, 23/00, B22F 3/17, C22C 1/00, C22F 1/00, 1/10,
1/18, C21D 7/02

(21) International Application Number: PCT/US00/23267

(22) International Filing Date: 24 August 2000 (24.08.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/150,429 24 August 1999 (24.08.1999) US

(71) Applicant (for all designated States except US): **SMITH & NEPHEW, INC.** [US/US]; 1450 Brooks Road, Memphis, TN 38116 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **LONG, Mark** [FR/US]; 911 Meda Street, Memphis, TN 38104 (US).
HUNTER, Gordon [US/US]; 8394 Drury Lane, Germantown, TN 38139 (US).

(74) Agents: **PRATT, John, S. et al.**; Kilpatrick Stockton LLP, Suite 2800, 1100 Peachtree Street, Atlanta, GA 30309-4530 (US).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— With international search report.

(88) Date of publication of the international search report:
25 May 2001

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 01/14602 A3

(54) Title: COMBINATION OF PROCESSES FOR MAKING WROUGHT COMPONENTS

(57) Abstract: The present invention combines pre-wrought processes with conventional forging processes to produce orthopaedic components at reduced cost and lead-time, but comparable to conventional forging in ductility and strength. In this invention, the wrought barstock used conventionally for forging feedstock is replaced with a preform, blank, bar or other pre-wrought material exhibiting the required ductile strength and refined grain structure to be forgeable. A critical aspect of this invention is that the fine grain structure of the pre-wrought material provides improved ductile strength and sufficient forgeability to the material. This bar or preform may then be forged to produce grain size refinement and increase in material integrity. Three categories of pre-wrought processes according to the invention include forming the material using metal molds; processes that achieve the necessary ductility and refined grain structure for wrought processing through rapid heat removal through the component or a quenching atmosphere or gas; and processes that achieve the necessary ductility and refined grain structure through consolidation of powder or semi-solid material under conditions which restrict coarsening of the grain structure.

INTERNATIONAL SEARCH REPORT

Intern al Application No
US 00/23267

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B22D15/00 B22D27/04 B22D23/00 B22F3/17 C22C1/00
C22F1/00 C22F1/10 C22F1/18 C21D7/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B22D B22F C22C C22F C21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 665 299 A (MAZDA MOTOR) 2 August 1995 (1995-08-02) page 3, paragraphs 3,4; claim 1 page 6, line 26 - line 36 ---	1
X	DATABASE WPI Section Ch, Week 198428 Derwent Publications Ltd., London, GB; Class M22, AN 1984-173383 XP002159468 -& JP 59 094555 A (SHOWA KEIKINZOKU KK), 31 May 1984 (1984-05-31) abstract ---	1
X	WO 91 13181 A (ALLIED SIGNAL INC) 5 September 1991 (1991-09-05) page 3, line 33; claims 1,2,4 ---	36
	-/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *Z* document member of the same patent family

Date of the actual completion of the international search

6 February 2001

Date of mailing of the international search report

16/02/2001

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax (+31-70) 340-3016

Authorized officer

Gregg, N

INTERNATIONAL SEARCH REPORT

Interr. Application No

/US 00/23267

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 414 620 A (PECHINEY RECHERCHE) 27 February 1991 (1991-02-27) page 4, paragraph 2; claim 1 ---	17
A	GB 1 472 939 A (OSPREY METALS LTD) 11 May 1977 (1977-05-11) claim 1 ---	17
A	WO 98 33610 A (AMCAN CASTINGS LIMITED) 6 August 1998 (1998-08-06) claim 1 ---	49
A	US 4 775 426 A (MURLEY JOHN ET AL) 4 October 1988 (1988-10-04) cited in the application ---	
A	US 5 729 883 A (OYAMA MAKOTO ET AL) 24 March 1998 (1998-03-24) cited in the application ---	
A	G.N.COLVIN: "TITANIUM '95 :SCIENCE AND TECHNOLOGY, PAGES 691-701, "PERMANENT MOULD CASTING OF TITANIUM AEROSPACE AND AUTOMOTIVE HARDWARE" " 1995 , INSTITUTE OF MATERIALS , LONDON, GB XP000957923 cited in the application -----	

INTERNATIONAL SEARCH REPORT

Information on patent family members

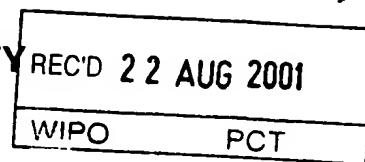
International Application No

US 00/23267

Pat nt document cited in search report		Publication date	Patent family memb r(s)	Publication date
EP 0665299	A	02-08-1995	JP 7224344 A DE 69423335 D DE 69423335 T US 6143097 A	22-08-1995 13-04-2000 30-11-2000 07-11-2000
JP 59094555	A	31-05-1984	NONE	
WO 9113181	A	05-09-1991	US 5078806 A EP 0516750 A JP 5504602 T	07-01-1992 09-12-1992 15-07-1993
EP 0414620	A	27-02-1991	FR 2651244 A CA 2023900 A DE 69006293 D DE 69006293 T JP 1822336 C JP 3097824 A JP 5034411 B NO 176483 B US 5073207 A	01-03-1991 25-02-1991 10-03-1994 26-05-1994 10-02-1994 23-04-1991 24-05-1993 02-01-1995 17-12-1991
GB 1472939	A	11-05-1977	DE 2537103 A FR 2282315 A JP 1075654 C JP 51046554 A JP 56012220 B SE 7509264 A	04-03-1976 19-03-1976 25-12-1981 21-04-1976 19-03-1981 23-02-1976
WO 9833610	A	06-08-1998	CA 2196479 A CA 2227828 A AU 5850098 A EP 1011897 A	01-08-1998 31-07-1998 25-08-1998 28-06-2000
US 4775426	A	04-10-1988	NONE	
US 5729883	A	24-03-1998	JP 7227639 A	29-08-1995

PATENT COOPERATION TREATY

PCT



INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference S0441/206606	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US00/23267	International filing date (day/month/year) 24/08/2000	Priority date (day/month/year) 24/08/1999
International Patent Classification (IPC) or national classification and IPC C21D7/00		
Applicant SMITH & NEPHEW, INC. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 7 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 21/02/2001	Date of completion of this report 20.08.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Flink, E Telephone No. +49 89 2399 2919

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/US00/23267

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1-13 as originally filed

Claims, No.:

1-69 as originally filed

Drawings, sheets:

1/7-7/7 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/US00/23267

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	2,3,5-7,9-16,18-23,25-35,37-48,50-54,56-61,63,65,67,69
	No:	Claims	1,4,8,17,24,36,49,55,62,64,66,68
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-69
Industrial applicability (IA)	Yes:	Claims	1-69
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following documents:

D1: Titanium '95: Science and Technology, pages 691-701

D2: Database WPI, Section Ch, Week 198428, Derwent Publications Ltd., AN 1984-173383 & JP-A-59094555

D3: EP-A-0665299

D4: EP-A-0414620

D5: WO-A-91/13181

D6: WO-A-98/33610

D7: GB-A-1472939

2. The object of the invention is to provide a process for the production of a component, in particular an orthopaedic component, by casting, incremental forming, or consolidation processes followed by wrought processes at reduced cost and lead-time, but comparable to conventional forgings in ductility and strength (see page 1, lines 3-6 and page 1, line 27 - page 2, line 14).

This object is achieved with the process according to the independent claims 1, 13, 17, 31, 36, 47, 49 and 60.

Further, the invention relates to components, in particular orthopaedic components, according to the independent claims 62-69 formed by such processes.

3. a) Document D1 discloses a process for producing a component, comprising casting a blank using a metal mold which imparts sufficient conductive heat transfer from the blank to achieve rapid cooling of the blank and subsequently forging (by pressing) the blank to produce said component (see pages 693-695). Document D1 does not explicitly mention that a blank having a fine grain structure is produced during casting of said blank. However, in view of the rapid cooling of the blank, this must also be the case in D1 (see page 694, line 3). Further cracking or non-uniform flow during forging does not take place in D1 (at least it is not mentioned in D1).

Therefore, the subject-matter of claim 1 lacks novelty (Article 33(2) EPC).

For the same reason the subject-matter of claim 62, relating to a component formed according to the process of claim 1, lacks novelty (Article 33(2) PCT).

The features of claims 4 and 8 are also known from D1 (see the above mentioned passages).

Therefore, the subject-matter of said claims also lacks novelty (Article 33(2) PCT).

b) Documents D2 and D3 disclose a process for producing a component, comprising casting a blank using a mold which imparts sufficient conductive heat transfer from the blank to achieve rapid cooling of the blank in order to produce a blank with a fine grain structure and subsequently forging the blank to produce said component (see D2: abstract and D3: claims 18 and 19; page 4, lines 4-10 and page 6, line 4). These documents do not explicitly mention the use of a metal mold for casting said blank. This feature is described in document D1 as providing the same advantages as in the present application. The skilled person would therefore regard it as a normal design option to include this feature in the process described in documents D2 and D3 in order to solve the problem posed. Further cracking or non-uniform flow during forging does not take place in D2 and D3 (at least it is not mentioned in D2 and D3).

Therefore, the subject-matter of claim 1 does not involve an inventive step (Article 33(3) PCT).

Moreover, the component of claim 62 does not differ from the components obtained with the process of D2 and D3.

Therefore, the subject-matter of claim 62 lacks novelty (Article 33(2) PCT).

4. Document D4 discloses a process for producing a component, comprising forming a blank by incrementally applying material to portions of the blank already formed, thus building the blank in a manner which imparts conductive heat transfer from the applied material to portions of the blank already built to achieve rapid cooling of the applied material in order to produce a blank with a fine grain structure and subsequently forging the blank (see claims 1, 6, 7 and 9; page 3, line 41 - page 4, line 17). Further cracking or non-uniform flow during forging does not take place in D4 (at least it is not mentioned in D4).

Therefore, the subject-matter of claim 17 lacks novelty (Article 33(2) PCT).

For the same reason the subject-matter of claim 64, relating to a component formed according to the process of claim 17, lacks novelty (Article 33(2) PCT).

Moreover, the feature of claim 24 is known from D4 (see the above mentioned passages).

Therefore, the subject-matter of claim 24 also lacks novelty (Article 33(2) PCT).

5. Document D5 discloses a process for producing a component, comprising forming a blank by consolidating a powderized material under at least temperature and pressure conditions sufficient to restrict coarsening of grain structure of the material in order to produce a blank with fine grain structure and subsequently forging the blank to produce said component (see claims 1, 2 and 4; page 3, lines 23-32, page 5, lines 14-20, page 6, lines 24-37 and page 10, line 9 - page 11, line 9). Further cracking or non-uniform flow during forging does not take place in D5 (at least it is not mentioned in D5). Therefore, the subject-matter of claim 36 lacks novelty (Article 33(2) PCT).

For the same reason the subject-matter of claim 66, relating to a component formed according to the process of claim 36, lacks novelty (Article 33(2) PCT).

6. Document D6 discloses a process for forming a component, comprising forming a blank by consolidating a semi-solid material under at least temperature and pressure conditions sufficient to restrict coarsening of grain structure of the material in order to produce a blank with fine grain structure and subsequently forging the blank to produce said component (see claims 1, 6-8). Further cracking or non-uniform flow during forging does not take place in D6 (at least it is not mentioned in D6).

Therefore, the subject-matter of claim 49 lacks novelty (Article 33(2) PCT).

For the same reason the subject-matter of claim 68, relating to a component formed according to the process of claim 49, lacks novelty (Article 33(2) PCT).

Moreover, the feature of claim 55 is known from D6 (see the above mentioned passages).

Therefore, the subject-matter of claim 55 also lacks novelty (Article 33(2) PCT).

7. The additional features of claims 2, 3, 5-7, 9-16, 18-23, 25-35, 37-48, 50-54, 56-61,

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/US00/23267

63, 65, 67 and 69 are either derivable from D1-D6 and D7 (heat transfer from applied material to a gas; see claim 1) or come further within the scope of the customary practice followed by persons skilled in the art, especially as the advantages thus achieved can readily be contemplated in advance.

Consequently, the subject-matter of said claims does not involve an inventive step (Article 33(3) PCT).

Re Item VII

Certain defects in the international application

Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D2-D7 is not mentioned in the description, nor are these documents identified therein.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 194038PCT	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/US 00/ 23267	International filing date (day/month/year) 24/08/2000	(Earliest) Priority Date (day/month/year) 24/08/1999
Applicant SMITH & NEPHEW, INC. et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

☒ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/23267

A. CLASSIFICATION OF SUBJECT MATTER IPC 7 B22D15/00 B22D27/04 B22D23/00 B22F3/17 C22C1/00 C22F1/00 C22F1/10 C22F1/18 C21D7/02		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC 7 B22D B22F C22C C22F C21D		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, WPI Data, PAJ		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 665 299 A (MAZDA MOTOR) 2 August 1995 (1995-08-02) page 3, paragraphs 3,4; claim 1 page 6, line 26 - line 36 ---	1
X	DATABASE WPI Section Ch, Week 198428 Derwent Publications Ltd., London, GB; Class M22, AN 1984-173383 XP002159468 -& JP 59 094555 A (SHOWA KEIKINZOKU KK), 31 May 1984 (1984-05-31) abstract ---	1
X	WO 91 13181 A (ALLIED SIGNAL INC) 5 September 1991 (1991-09-05) page 3, line 33; claims 1,2,4 --- -/--	36
<input checked="" type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in annex.		
* Special categories of cited documents : *A* document defining the general state of the art which is not considered to be of particular relevance *E* earlier document but published on or after the international filing date *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) *O* document referring to an oral disclosure, use, exhibition or other means *P* document published prior to the international filing date but later than the priority date claimed *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. *&* document member of the same patent family		
Date of the actual completion of the international search 6 February 2001		Date of mailing of the international search report 16/02/2001
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer Gregg, N

INTERNATIONAL SEARCH REPORT

International Application No

T/US 00/23267

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 414 620 A (PECHINEY RECHERCHE) 27 February 1991 (1991-02-27) page 4, paragraph 2; claim 1 ---	17
A	GB 1 472 939 A (OSPREY METALS LTD) 11 May 1977 (1977-05-11) claim 1 ---	17
A	WO 98 33610 A (AMCAN CASTINGS LIMITED) 6 August 1998 (1998-08-06) claim 1 ---	49
A	US 4 775 426 A (MURLEY JOHN ET AL) 4 October 1988 (1988-10-04) cited in the application ---	
A	US 5 729 883 A (OIYAMA MAKOTO ET AL) 24 March 1998 (1998-03-24) cited in the application ---	
A	G.N.COLVIN: "TITANIUM '95 :SCIENCE AND TECHNOLOGY, PAGES 691-701, "PERMANENT MOULD CASTING OF TITANIUM AEROSPACE AND AUTOMOTIVE HARDWARE" " 1995 , INSTITUTE OF MATERIALS , LONDON, GB XP000957923 cited in the application -----	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 00/23267

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0665299	A	02-08-1995	JP 7224344 A	22-08-1995
			DE 69423335 D	13-04-2000
			DE 69423335 T	30-11-2000
			US 6143097 A	07-11-2000
<hr/>				
JP 59094555	A	31-05-1984	NONE	
<hr/>				
WO 9113181	A	05-09-1991	US 5078806 A	07-01-1992
			EP 0516750 A	09-12-1992
			JP 5504602 T	15-07-1993
<hr/>				
EP 0414620	A	27-02-1991	FR 2651244 A	01-03-1991
			CA 2023900 A	25-02-1991
			DE 69006293 D	10-03-1994
			DE 69006293 T	26-05-1994
			JP 1822336 C	10-02-1994
			JP 3097824 A	23-04-1991
			JP 5034411 B	24-05-1993
			NO 176483 B	02-01-1995
			US 5073207 A	17-12-1991
<hr/>				
GB 1472939	A	11-05-1977	DE 2537103 A	04-03-1976
			FR 2282315 A	19-03-1976
			JP 1075654 C	25-12-1981
			JP 51046554 A	21-04-1976
			JP 56012220 B	19-03-1981
			SE 7509264 A	23-02-1976
<hr/>				
WO 9833610	A	06-08-1998	CA 2196479 A	01-08-1998
			CA 2227828 A	31-07-1998
			AU 5850098 A	25-08-1998
			EP 1011897 A	28-06-2000
<hr/>				
US 4775426	A	04-10-1988	NONE	
<hr/>				
US 5729883	A	24-03-1998	JP 7227639 A	29-08-1995
<hr/>				